The International Conference on Management, Business, Economics, Law and Technology (COMBELT-2025)

August 01st, 2025, Danang, Vietnam

From Knowledge To Sustainability: Thematic Evolution In Digital Transformation Research

Chinh Nguyen Vinh[a]✉, Nguyen Bui Huynh[a], Thu Nguyen Thi[a], Hien Duong Thuy[a], Diem Nguyen Phuong[a]

[a]The University of Danang - University of Economics, 71 Ngu Hanh Son Street, Bac My An, Ngu Hanh Son, Da Nang City 550000, Vietnam

ABSTRACT

This paper presents a thorough bibliometric investigation into the field of Digital Transformation (DT) from 1997 to 2025, shedding light on its thematic progression, international research collaborations, and notable academic outputs. Utilizing a dataset of 759 articles from the Web of Science, along with tools like Biblioshiny and ASReview Lab, the study identifies prevailing research trends, key contributors, and evolving topic clusters. The analysis reveals a clear transition from foundational issues, such as governance and knowledge management, to more advanced concerns, including artificial intelligence, sustainability, and resilience, particularly in response to the post-COVID-19 landscape. Motor themes include financial performance, user acceptance, and R&D, while new topics such as sustainability and international expansion are gaining momentum. The findings highlight the cross-disciplinary nature of Digital Transformation, its worldwide significance, and its critical function in fostering innovation and sustainable development. In addition, the study explores practical implications for managers and policymakers, while proposing direction for future research, especially in less-studied regions and evolving academic areas.

Keywords: digital transformation, bibliometric analysis, sustainability, interdisciplinary research.

1. Introduction

In the past few years, corporate executives' strategy conversations about growth and market expansion have frequently focused on the subject of digital transformation (DT) (Buss, 2018).

✉ Corresponding author. Tel.: +84935603815.
Email address: vinhchinh123456@gmail.com

Managers and experts emphasize that DT is not only a critical driver of development but also unlocks diverse market opportunities for organizations (Schroeck et al., 2019). DT challenges businesses' competitiveness by obfuscating the lines between industries and organizations (Lyytinen et al., 2016). The effects of DT appear to go beyond those of earlier stages of IT-enabled transformation, which were typically associated with the practice level and relatively incremental change inside enterprises (Orlikowski, 2000). One example of this is the emergence of new digital business models even in non-digital industries. According to Poole & Van de Ven (2004), DT appears to have a more complex and all-encompassing relationship with the subject of organizational change, necessitating a more comprehensive analysis and comparison with the literature on organizational change and innovation.

During a pandemic, implementing physical distancing becomes of utmost importance, which necessitates physically reducing the on-site worker positions. It is also during these times that paperless workflows accelerate and reduce human interaction and therefore, operational expenses, along with the potentiality of business interactions being plagued with errors, mistakes, and inaccuracies. Therefore, the need to deploy connected worker strategies and connected technology is paramount. Organizations require integrated data systems, horizontal integration with customers and suppliers, access to real-time performance, and advanced capabilities in big data analytics to facilitate this action. So that, the organizations are adopting digital solutions such as connected worker systems, data analysis, AI, and Internet of Things to enhance resilience and continuity (Nah & Siau, 2020).

DT represents more than simply introducing new technologies; it represents a complete transformation of organizations to digital workplaces, dramatically accelerated as a result of global disruption triggered by events like the COVID-19 pandemic, illustrating the importance of digital readiness. While the field has been expanding as a result of considerable scholarship, it is inconsistent in its center of gravity, addressing the various themes with diverse ranges of focus in the literature, from technological enablers to organizational and managerial challenges (Hajishirzi et al., 2022). Some researchers have focused on examining DT's drivers, ranging from internal factors such as workflow improvement, internal system integration, to external influences such as customer demands, market pressures, the role of the supply chain, and government support (Liere-Netheler et al., 2018; Papagiannidis et al., 2020). Others have focused on assessing a company's digital transformation readiness, which focuses on seven core aspects including resources, information technology, awareness, collaboration, innovation propensity, culture, and strategy (Lokuge et al., 2019). Therefore, in this study, we want to organize and explore the way researchers studied DT in the past. Our specific objectives are :

RQ1: What are the key themes related to the digital transformation that have been investigated by scholars?

RQ2: How have digital transformation-related topics changed over time?

To gain these objectives, we employ a bibliometric analysis, a potential technique for quantitatively analysing the structure and development of academic literature and a systematic method for quantitatively assessing scientific literature to identify patterns, trends, and impact within a field (Lazarides et al., 2023) to give a thorough picture of the state of DT research. This study

attempts to provide insight into the development of DT research and its influence on practice by examining publication trends, citation patterns, and thematic evolution.

Our study makes a number of key contributions to DT research. First, it provides a bibliometric starting point for DT research across nearly three decades (1997–2025). The data illustrates the development of research themes that began with foundational research topics like governance and knowledge management and now includes timely research topics like artificial intelligence, sustainability, and resilience in the context of a post-COVID-19 world. Second, our study maps DT research globally by indicating key contributors to DT research, key institutions, and key countries. Mapping these key contributors reveals the collaborative nature of an interdisciplinary field. Third, through the analysis of thematic evolution and visualization of research clusters through thematic maps, it helps with central, niche, and emerging themes that have identified priorities for the current and future directions of research. Further, this paper advances implications for practice and policy makers by bringing to the forefront the role of DT in enhancing competitiveness, sustainable development, and informing policy makers' responsibilities. Finally, this paper outlines future research opportunities for researchers by underscoring the need to explore relatively unexplored regions represented in DT research and urgent challenges.

2. Literature review

According to many previous studies, as shown in Table 1, the concept of DT of each study was related clearly to its area, in which that researchers did the exploration, ranging from business and technological innovation to finance and labor management. Across different fields, the definitions of DT are adjusted separately and specifically to meet the research objectives and scopes of each research. As a result, there are some inconsistencies in the way they define DT. In our research, we will consider digital transformation as a phenomenon in which companies and governments apply technology to their operations. Besides, the phenomenon is defined as a "difference in form, quality, or state over time in an organizational entity," and it is logically related to the subject of organizational change (Van de Ven and Poole, 1995, p. 512). Therefore, this systematic literature review presents a comprehensive picture of digital transformation phenomena over time in a variety of fields that have been investigated by numerous researchers to date.

Table 1. Definition of DT in previous studies

Author(s)	Definition of Digital Transformation (DT)
Negroponte (1997)	"Enterprises' digital transformation is the digital penetration of production factors, the digital restructuring of production relationships, and the digital innovation of business activities.
BOWERSOX et al., 2005)	Digital business transformation (DBT) is a "process of reinventing a business to digitize operations and formulate extended supply chain relationships," and further develops that it is "about reenergizing businesses that may already be successful to capture the full potential of information technology across the total supply chain

Martin (2008)	Nowadays, the term "digital transformation" refers to the usage of Information and Communication Technology when significant new capabilities are developed in industry, public governance, and the lives of individuals and society as a whole, rather than just minor automation.
Mazzone (2014)	"Digital transformation is the deliberate and ongoing digital evolution of a company, business model, idea process, or methodology, both strategically and tactically."
Wei et al. (2022)	"as the advanced transformation involved in utilizing a new generation of information technology to change and upgrade existing technological and production systems, in order to optimize production methods and improve management levels."

DT has actively boosted the innovation capacity of enterprises to a significant degree. The interconnection between digital technology and the real economy is facilitating enterprises to enhance epidemic prevention and control, the restart of production, and a new driving force for economic rejuvenation. Enterprises have used DT as a method of innovation and restructuring actively, and are promoting the development of the digital economy with great enthusiasm. DT optimizes operational activities, enriches business models, and reconstructs organizational structures, enabling companies to achieve self-innovation (Zhao et al., 2024). The development of digital technology leads to a systematic change in competition, business models, operating processes, and even business ecosystems, driving resource allocation in enterprises towards smart, precise, and efficient directions (S. Li et al., 2023). Enterprise DT is the process of utilizing a new generation of information technology to change and upgrade existing technological and production systems, optimizing production processes, and improving management level (Chen & Kim, 2023). Schneider & Kokshagina (2021) have indicated five thematic spaces affected by DT: organizational governance, business strategy, marketing, leadership, and employee management. They emphasized the growing appropriateness of technologies such as artificial intelligence (AI) and blockchain since 2017, highlighting their revolutionary capacity across different industries. Similarly, Hanelt et al. (2021) referred to DT's ability to fuel organizational innovation and strategic adaptation to technological disruption.

Research has shown impressive outcomes of DT, including improved operational performance, accelerated innovation, and increased customer satisfaction (Fitzgerald et al., 2014; Matt et al., 2015). For example, DT has been demonstrated to drive business model innovation by data-driven decision making and cross-functional collaboration (Bresciani et al., 2021). It is also evident through research how DT assists in building organizational resilience, especially across global crises such as the COVID-19 pandemic, where flexible digital infrastructure supports continuity and adaptation (Carroll & Conboy, 2020). But evidence from the literature does present contradictions, like implementation failure, change resistance, and strategic priority misalignment (Hanelt et al., 2021)

In recent years, bibliometric analysis tools have gained traction as a way to dive deeper into the evolution of DT research and its applications across various sectors. Most bibliometric analyses of DT research have concentrated on foundational themes such as technology adoption, organizational change, and digital ecosystems. For example, Correani et al. (2020) pinpointed topic clusters like "Industry 4.0" and "smart manufacturing," but the data only covered up to 2020, missing out on significant shifts brought about by recent global disruptions. Another recent study employed tools like VOSviewer and SciMAT to examine research topics, authors, and organizations within the DT arena. The findings indicated a notable surge in DT studies in recent years, with particular focus on areas like information technology and project management, as highlighted by Vaska et al. (2021). This is the reason why, while previous bibliometric analyses have been insightful, they often lack cross-disciplinary integration and tend to overlook small and medium-sized enterprises (SMEs) in developing economies (Hanelt et al., 2021). Judijanto (2025) also utilized DT bibliometric research to shed light on the current landscape of academic research, the structure of topics, and emerging trends. The networks of co-presence and co-authorship reveal the field's diversity and interdisciplinary character, underscoring its significance in technology, management, and operations. However, this research did not reflect the change in DT over time.

There's a real need for a thorough bibliometric analysis to capture how DT research has evolved over the last twenty years, spotlight the main contributors, and explore the global networks that fuel innovation in this area. This paper addresses those gaps by performing an in-depth bibliometric analysis of DT research from 1997 to 2025, offering a detailed look at how the field has developed and its role in promoting global collaboration, innovation, and inclusive growth.

3. Methodology

This study conducts an extensive bibliographic analysis to explore the development and influence of DT research, emphasizing its outputs and functions as a mediator and coordinator.

The data used for this analysis are sourced from Web of Science, a leading and comprehensive scholarly database, ensuring a reliable and high-quality dataset.

Data Collection: The initial dataset was collected by searching for articles containing the keyword "DT" along with related terms such as "DT effectiveness", "effect of DT". This comprehensive search method aimed to cover a wide range of DT-related studies. It can be seen from the fact that the research attracted 925 articles during 1997-2024, which in turn gives us a bird's eye view of the whole process of DT research development. Through these articles, a broader understanding of the subject matter was gained. Web of Science - a database by which the downloaded articles were found initially, provides an overview of the development that happened in this research subject for the whole period of the publication.

Data Screening: To refine the dataset, a manual screening process was conducted using ASReview Lab, an open-source tool designed for systematic reviews. This tool facilitated the identification of articles that specifically focused on DT outcomes, as well as studies where DT was examined as a mediator or moderator. After application of this criterion, the dataset was narrowed down to 759 articles that are most relevant to the domain that was the main concern of the study.

This manual screening was required to eliminate unnecessary articles from the final sample and to refine the analysis process to accreditation of a valid and focused study.

Bibliometric Analysis: The study used Biblioshiny, a web-based tool integrated with R and the Bibliometrix package, known for its extensive bibliometric analysis features. Because of its intuitive interface and advanced analytical capabilities, Biblioshiny was chosen to facilitate an in-depth assessment of key bibliometric indicators. These indicators include publication trends, citation dynamics, co-citation networks, and topic evolution over time. The platform's visualization tools were used in this study to construct collaboration networks, thematic maps, and trend analyses to provide a comprehensive overview of the research field.

Under the light of verified data collection and screening processes and employing complex bibliometric techniques, the authors of this study confirmed the reliability of the results and said the study was mostly correct in composition

4. Result

4.1. Descriptive statistics

Figure 1. Main information about the data

Source: Compiled by the author

From 1997 to 2025, the dataset utilized for the bibliometric analysis of DT research covers a roughly three-decade-long evolution that is still growing (Figure 1). The collection, which consists of 759 documents from 362 academic sources, demonstrates the variety of scholarly works in this area. An annual growth rate of 13.05% highlights the consistent momentum of research and confirms the topic's importance in the face of rapid technological advancements.

Only 103 documents (around 13.5%) were single-authored, out of 2,208 authors who contributed to the literature. This suggests that the academic community has a strong collaborative culture. The average number of co-authors for each document is 3.24, highlighting how collaborative this interdisciplinary field is. The international collaboration rate of 33.6%, however, indicates that there is potential for growing global connections.

A strong theoretical foundation and substantial knowledge inheritance are reflected in the 40,648 references and the average of 15.45 citations per document, which exhibit academic impact. The average document age of 2.94 years emphasizes the recency and up-to-date nature of the research, keeping up with the rate of technical advancement. The identification of 4,017 authors' keywords demonstrates the variety and depth of subjects covered in this field.

Journal articles make up the majority of the documents, with a total of 759 documents. This distribution reflects the global interconnected network and dynamic nature of the subject, which highlights the predominance of journal publications in sharing research findings on DT. The heavy emphasis on journal articles demonstrates that, in keeping with the quick speed of technical advancement, DT research is continuously updated.

(a) (b)

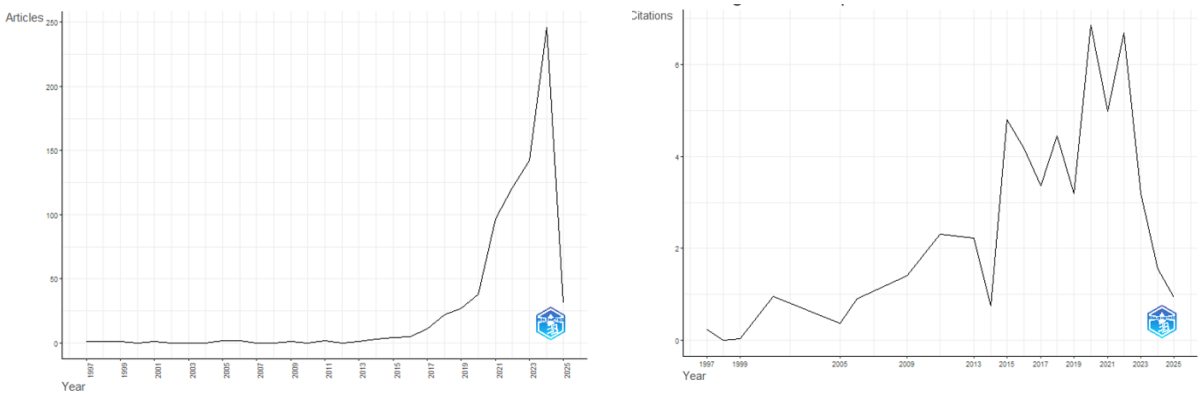

Figure 2. (a) Annual Scientific Production; (b) Average Citation per Year

Source: Compiled by the author

Data on research output on DT covers a development history of almost three decades, from 1997 to 2025 (Figure 2a). In the initial years (1997 - 2003), only sporadic research, which reflected the field's modest beginnings in the context of emerging digital technologies. The number of studies steadily increased between 2005 and 2011, which is when the first theoretical underpinnings and real-world applications were formed. A consistent increase was observed over the 2013–2017 period, coinciding with the global DT wave and the introduction of innovative technologies like cloud computing, AI, and IoT. Notably, research productivity increased significantly between 2019 and 2021, most likely as a result of the COVID-19 pandemic, which exacerbated the pressing need for digitization around the world. This expansion highlights the critical role that DT plays in tackling socio-economic issues. Projected trends toward 2025 indicate sustained momentum, reflecting ongoing technology improvements and the need for enterprise system optimization. The 2023–2025 forecasted stabilization of research output, however, points to a move from experimental stages to widespread adoption with an emphasis on sustainability and long-term effectiveness.

Over the years, research on DT has experienced a robust growth cycle (Figure 2b). In the late 1990s and early 2000s, the average citations per year were extremely low. Citations steadily rose between 2005 and 2011, indicating the field's increasing popularity. The number of citations skyrocketed between 2012 and 2018, reaching a peak of over six citations annually around 2019 and 2020, suggesting that this was the height of research on DT. But after 2021, citations started to drop very quickly, and by 2023–2024, they had dropped to a very low level. When significant research has been published and there aren't many novel discoveries, the field may be saturated, or the increase in the number of research papers has reduced the citations of each paper.

4.2. Key Contributors and Influential Works

An overview of the most significant journal sources for research on DT is shown in the above graphic. With 27 publications, Technological Forecasting and Social Change comes in first, highlighting the significance of this subject in relation to social change and technical forecasting. The wide interest in DT from the domains of economics, finance, and knowledge innovation is reflected in other journals like Financial and Credit Activity Problems of Theory A (24 articles), Journal of the Knowledge Economy (21 articles), and Baltic Journal of Economic Studies (17 articles). Furthermore, publications like the Journal of Innovation & Knowledge (11 articles) and the Journal of Company Research (12 articles) show how closely company management, innovation, and DT are related. Research on DT goes beyond technology to the domains of energy and international marketing, as evidenced by academic sources with fewer publications, such as Energy Economics, International Marketing Review, or Economic Annals-XXI (8 articles each). With participation from disciplines ranging from business and technological innovation to economics and finance, the articles' distribution across many journals highlights the interdisciplinary character of DT. This illustrates how DT is becoming increasingly significant in both academics and practice, necessitating multifaceted study and collaboration to fully realize its promise.

(a) (b)

Figure 3. (a) Most Relevant Affiliation; (b) Most Relevant Source

Source: Compiled by the author

Figure 3a shows the most relevant affiliations of authors contributing to research on DT. Leading the way with 21 participating researchers is Renmin University of China, followed by Tsinghua University with 19 articles and Kyiv National Economic University with 17 articles. This shows how universities are at the forefront of DT research and emphasizes the significance of digital economic applications in the transformation process.

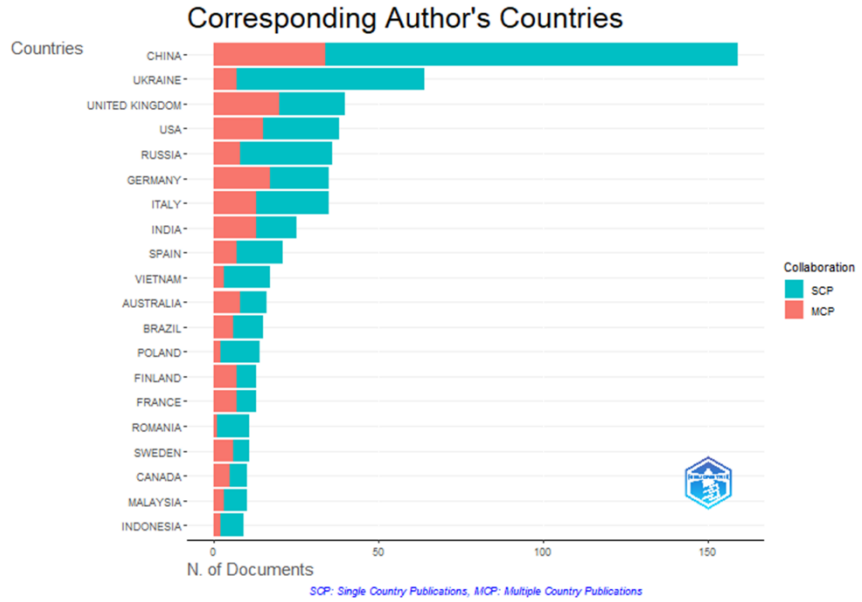

Figure 4. Corresponding Author's Countries

Source: Compiled by the author

Based on the nation of the corresponding author, Figure 4 shows the distribution and trends of international collaboration in DT research. There is a concentration of resources in this area, as seen by the large number of publications from economically and technologically developed countries, including China, the USA, the UK, Germany, and Australia. Among them, the USA and the United Kingdom stand out with a high multinational collaboration percentage (MCP) of 50% and 39.47% in the given order, reflecting their extensive global research networks. In contrast, although China and Ukraine have a large number of publications, their MCP rate is lower (21.38% and 10.93%, respectively), indicating a focus on domestic research priorities. Publications in developing nations like Vietnam, Malaysia, and Indonesia are still small but are steadily rising. However, because of budgetary limitations and language problems, their MCP rates are poor. The overall pattern demonstrates the dominance of industrialized and English-speaking nations while exposing disparities in research approaches: some countries place a higher value on technical independence, while others use cooperation to increase their sway.

4.3. Thematic evolution

The research on Digitalization has experienced considerable evolution with the focus shifting over the past nearly three decades, reflecting the dynamic nature of the field and its broadening influence across various domains. A strategic analysis of Thematic Evolution from 1997 to 2025 (Figure 5), supported by an overall thematic map (Figure 6), gives useful insights into how important themes in DT research have developed, matured, and diversified, particularly in connection with DT's outcomes.

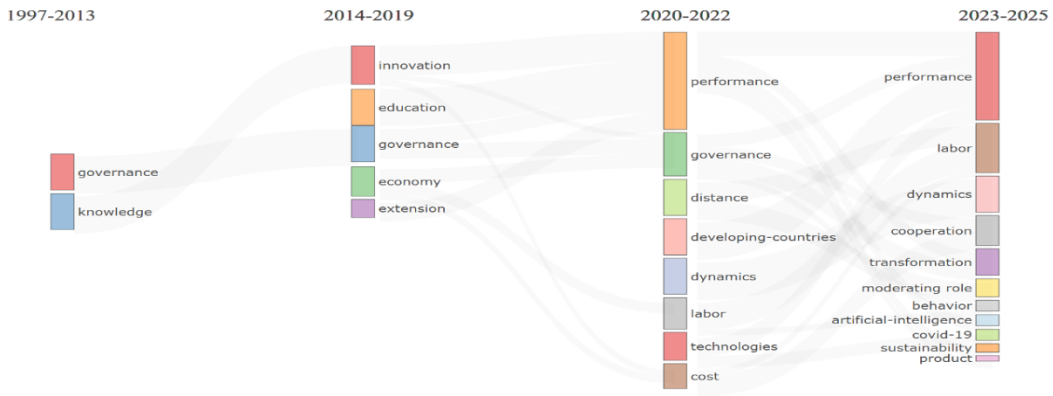

Figure 5. Thematic Evolution

Source: Compiled by the author

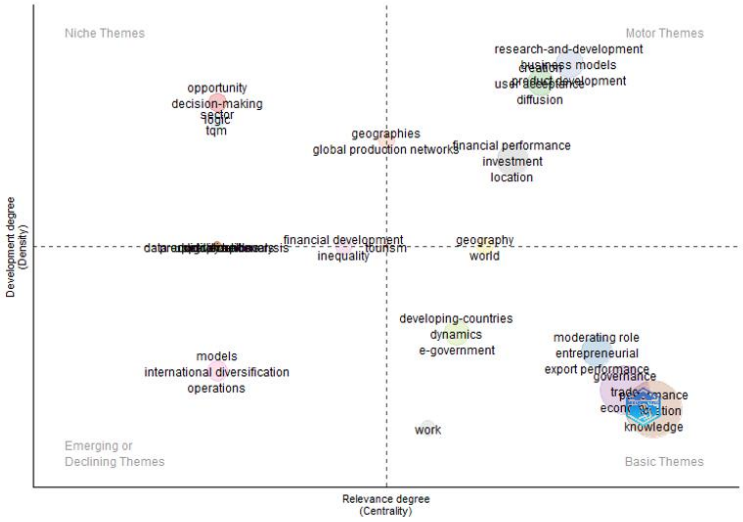

Figure 6. Thematic Map

Source: Compiled by the author

The thematic evolution chart (Figure 5) illustrates the progressive improvement of DT over four distinct periods: 1997-2013, 2014-2019, 2020-2022, and 2023-2025. The initial research phase (1997-2013) focused on foundational themes such as "governance" and "knowledge," which laid the theoretical groundwork for the field. Between 2014 and 2019, alongside the growth of the Fourth Industrial Revolution, the scope of research broadened to encompass areas such as "education," "innovation," and "economy," highlighting the growing relevance of DT in innovation and business practices. The period from 2020 to 2022 witnessed a shift in focus toward interconnected themes such as "performance," "distance," and "developing countries," emphasizing DT's role in addressing geographical and developmental disparities among countries. In the most recent phase (2023–2025), the focus has turned to themes like "sustainability" and "artificial intelligence," reflecting both the steady, long-term growth of technology and efforts toward post-COVID-19 recovery. However, “performance” still played a key role throughout this period. This progression of themes

corresponds with the thematic map's categories of driving, niche, foundational, and emerging or declining themes, providing a well-rounded perspective on the evolution of DT research.

In the thematic map, the vertical axis shows the development intensity (density) of each theme, which reflects how thoroughly a particular topic has been investigated in academic research. The horizontal dimension, on the other hand, shows the centrality of each theme, indicating its level of influence and relevance within the broader field of Digitalization studies. The map categorizes themes into four quadrants—motor, niche, basic, and emerging or declining—providing a clear and systematic way to analyze how different research areas have evolved and where they currently stand in the academic discourse.

This thematic overview brings together insights from all examined time periods, offering a strategic depiction of the present state of DT research. Motor themes such as "research and development," "financial performance," and "user acceptance" continue to play an important role, guiding the direction of scientific research and demonstrating DT's effect on both organizational and national performance. Niche themes like "opportunity" and "decision-making" represent more focused yet well-established areas of study, which, although less central, reflect the expanding scope of the DT research agenda. In contrast, themes such as "operation," "international diversification," and "models" are identified as either emerging or declining, pointing to topics that may either be gaining traction or fading in relevance. In particular, "international diversification"—a sophisticated strategy at the corporate level that serves as an alternative to product diversification (Hitt et al., 2006) - and provide multinational enterprises with new growth avenues, while also intensifying the demands for DT (Tihanyi et al., 2021).

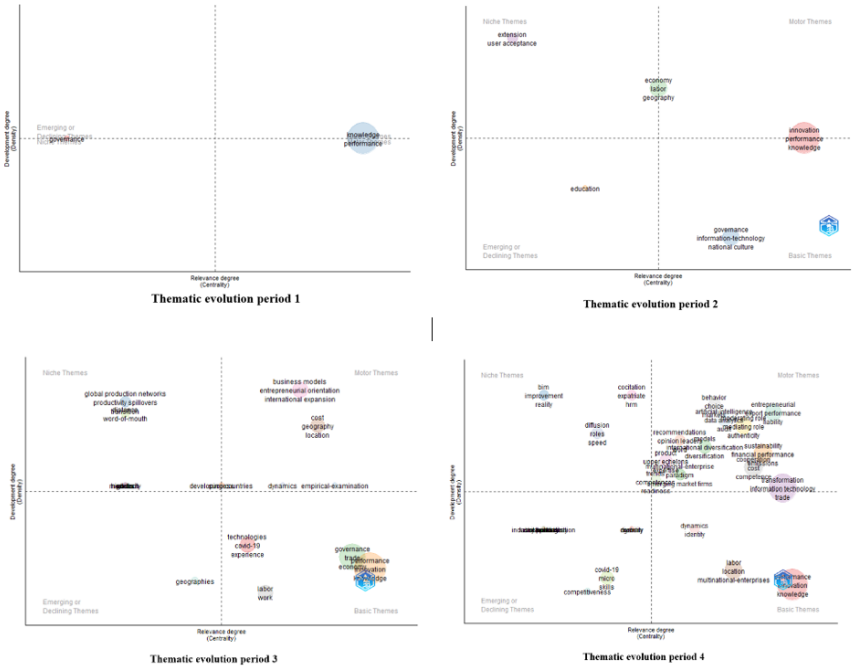

Figure 7. Thematic Evolution of DT Research Across Four Periods

Source: Compiled by the author

Figure 7 presents the evolutionary trajectory of DT research across four distinct phases, illustrating how core research themes have progressed from fundamental concepts to sophisticated, specialized domains.

The first phase (1997–2013) established the groundwork for DT scholarship. Research during this era was limited in scope, with most themes only moderately developed. Core concepts like "knowledge" and "performance" were established and became the theoretical foundation for more applied and specialized research.

The second phase (2014–2019), alongside the rise of Industry 4.0, witnessed an expansion in research focus. Emerging themes such as "economy," "labor," and "user acceptance" reflect a shift toward examining DT's cross-sectoral applications. This period also marks the appearance of "national culture" as a basic theme, reflecting the effect of the countries' environment on DT and the attention of researchers on the DT of MNEs.

During the third phase (2020–2022), DT became increasingly intertwined with global business strategy. Key themes such as "global production networks," "international expansion," and "cost" gained prominence, with "international expansion" emerging as a driving force in addressing the complexities of worldwide business, consisting of diverse markets and workforce dynamics.

The current phase (2023–2025) reflects the latest advancements in DT research, with heightened emphasis on "resilience" and "sustainability." These themes illustrate the field's growing alignment with sustainable development and green transformation initiatives - DT is increasingly viewed as a catalyst for accelerating sustainability transitions (George & Schillebeeckx, 2022a), particularly in the post-COVID-19 pandemic, causing a crisis on a global scale. The motor themes witness a significant growth in quantity across various domains, but globalization still plays a central role.

4.4. Interconnectedness and Collaboration

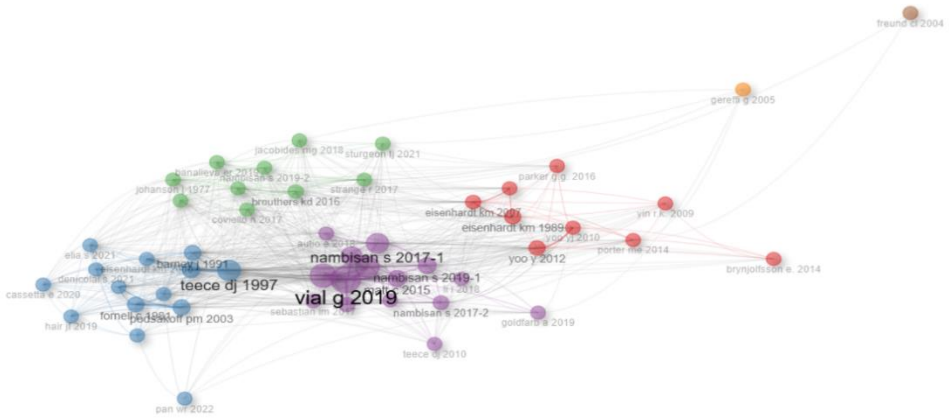

Figure 8. Co-Citation Network

Source: Compiled by the author

The Co-Citation Network (Figure 8) sheds light on the structural relationships within the DT research landscape by mapping influential publications and their interconnections. Among the most

foundational works are Teece et al. (1997), who proposed a framework to evaluate firm success in dynamic, innovation-oriented markets, and Vial (2019), who developed a comprehensive model for understanding DT. Network metrics identify Freund & Weinhold (2004) and Pan et al. (2022) as crucial bridging studies (high betweenness centrality), particularly in connecting DT research with productivity and global commerce literature. Furthermore, Teece et al. (1997), Vial (2019), and Nambisan et al. (2017) emerge as knowledge hubs (high closeness centrality), showing their pervasive influence across DT research.

The Collaboration World Map (Figure 9) illustrates the global distribution and strength of international partnerships in DT research. While collaboration occurs across various regions, Europe, the United States, China, and Australia stand out as key hubs of academic cooperation. The United Kingdom shows an outstanding position of collaboration frequency, co-authoring research with Australia (10 times), France (13), the US (12), and South Korea (10). China's partnerships with Australia and the U.S, while the U.S.'s ties with Germany, Italy, and France, show the cross-continental nature of studying scope in this field. Australia's considerable partnerships with the United Kingdom (10 instances) and the USA (3 instances) underline its position as a bridge between researchers from the West and the Asia-Pacific region. These international collaborations bring together a variety of viewpoints, contributing to the theoretical and practical advancement in DT. As noted by Bozeman & Corley (2004) such global partnerships often yield high-impact research, emphasizing the significance of international cooperation in progressing the field.

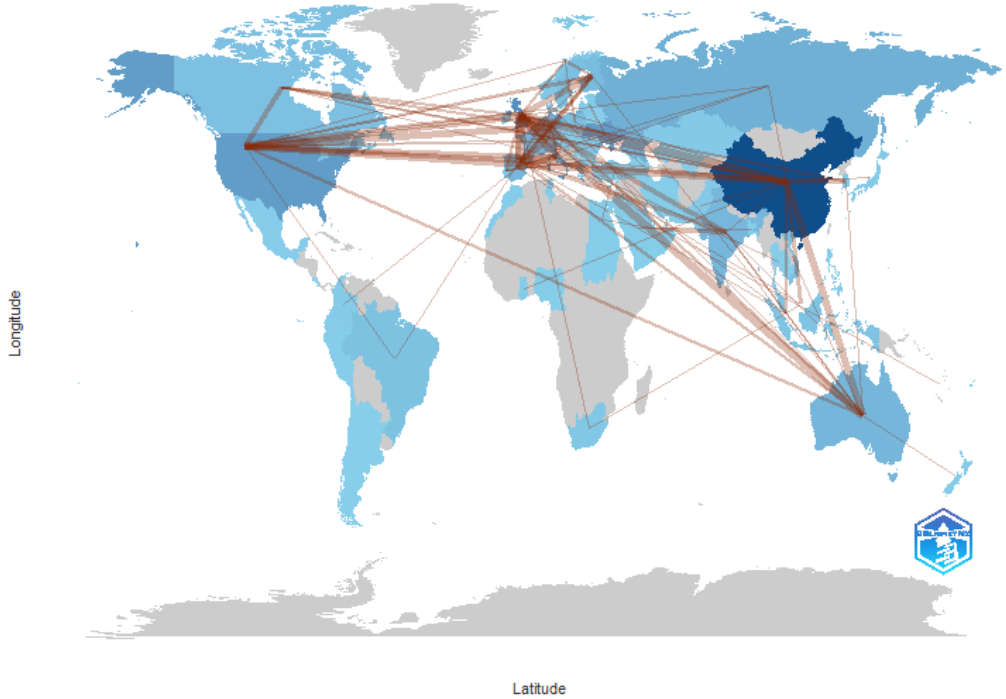

Figure 9. Collaboration World Map

Source: Compiled by the author

5. Discussion

The findings of this bibliometric analysis offer valuable insights into the growth and current landscape of DT research, emphasizing its significance for both theory and practice. As the field

continues to evolve, the thematic analysis reveals a distinct shift from core concepts to more advanced and focused topics such as “artificial intelligence” and “sustainability.” These advancements show that DT research and sustainable development are closely related (Broccardo et al., 2023).

The application of digital technologies such as artificial intelligence (AI), Internet of Things (IoT), and Big Data not only helps improve operational efficiency and optimize supply chains, but also supports businesses in minimizing resource waste and carbon emissions, thereby promoting sustainable development goals (Ghobakhloo, 2020; Li, 2020). Many studies have shown that businesses with a digital strategy linked to a sustainability orientation often gain a long-term competitive advantage, thanks to their ability to adapt well to increasingly stringent social and environmental requirements (George & Schillebeeckx, 2022b). In addition, digital transformation also opens up opportunities to improve inclusiveness and equity in the economy through expanding access to services, education, and markets for vulnerable groups (Li, 2020). Therefore, integrating digital transformation into a sustainable development strategy is not only a tactical choice but also a strategic orientation to ensure long-term growth for businesses and society.

One noteworthy conclusion drawn from the thematic map is that themes pertaining to knowledge, governance, and entrepreneurial success continue to be important yet unexplored areas in the discipline. Positioned in the lower-right quadrant as basic themes, these topics highlight their foundational significance while also revealing a lack of comprehensive theoretical advancement. For example, although entrepreneurial governance and knowledge transfer remain vital for understanding organizational performance in international settings, their low thematic density points to a scattered and underdeveloped body of research. Additionally, the field's increasing emphasis on innovation and adaptability in dynamic marketplaces is highlighted by key topics including "business models," "research and development," and "technology diffusion." (Zahra & George, 2002). However, despite their high centrality and density, there is a pressing need to integrate these themes into a more coherent conceptual framework that accounts for DT and the socio-political complexity of global business environments (Teece, 2018).

Moreover, our analysis identifies "financial performance," "user acceptance," and "research and development (R&D)" as motor themes that significantly influence the trajectory of scientific inquiry within DT. DT strategies are unequivocally recognized as primary drivers of enhanced financial performance (Teng et al., 2022). Organizations leverage their digital capabilities to augment efficiency, foster flexibility, boost output, and improve interconnectedness (Zhou et al., 2023). The thematic evolution during 2014–2019 reveals user acceptance as an emerging cross-sectoral application of DT (Oh et al., 2022). Additionally, R&D continues to be a cornerstone of motor theme in the realm of DT. Our study highlights the increasing imperative for innovation and adaptability within dynamic market environments (Y. Li & Zhang, 2024). Key topics such as "business models," "research and development," and "technology diffusion" are intrinsically linked to R&D. DT impacts various sectors, including organizational governance, business strategy, marketing, and leadership management (source).

Similar to previous findings, this study reaffirms the important role of DT in many sectors and shows the growing concerns about AI and sustainability (Judijanto, 2025) . The main novelty is that

this study covers a longer period (1997-2025), reflecting the changes in themes related to DT over time, both pre- and post - covid 19. The study points to a shift in research focus from fundamental issues to more advanced concerns (AI, sustainability).

6. Conclusion

This bibliometric study offers a thorough grasp of the development, major ideas, and contemporary patterns in DT research, demonstrating its increasing importance in both the academic and real-world spheres. This result suggests that DT research has advanced from broad issues like "knowledge" and "governance" to more specialized subjects like "artificial intelligence" and "sustainability." These changes demonstrate the growing significance of DT in a complex and dynamic environment where new digital breakthroughs are developed quickly.

6.1. Future research

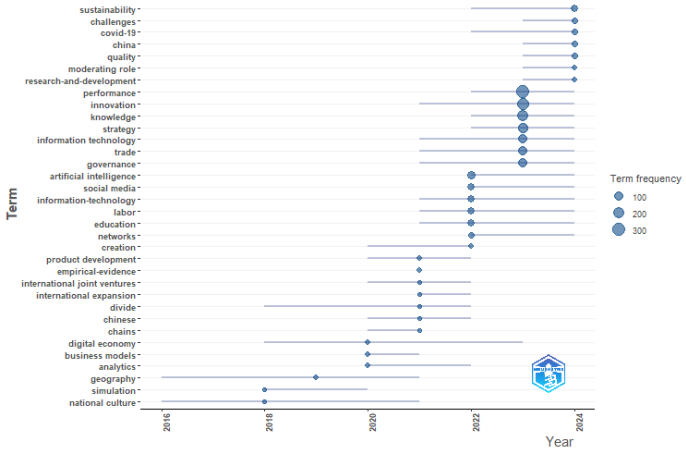

Figure 10. Trend Topics

Source: Compiled by the author

Although the field of DT research is significantly expanding, there are still many gaps and potential directions to be explored in the future. Main findings from the Topic Trends (Figure 10) and Thematic Evolution graphs illustrate that future research in the field of DT must be keenly attuned to both the thematic areas that are currently emerging and those foundational aspects that require further exploration. The thematic evolution analysis in this review has underscored the progression of research themes, from basic governance and knowledge management to sophisticated topics such as artificial intelligence (AI), sustainability, and resilience, particularly within the context of post-pandemic recovery. However, several underdeveloped and rapidly growing themes demand further scholarly attention.

Digital sustainability is a rapidly increasing theme with huge potential for future research. Studies have emphasized the transformative capability of DT in achieving sustainable goals, particularly in optimizing resource consumption and minimizing impact on the (Beier et al., 2020; Lopes de Sousa Jabbour et al., 2018). However, the number of extensive studies examining the sustainability impacts of DT across diverse industries is still limited, indicating a crucial realm for future scientific research.

Another emerging theme - AI - has seen a marked acceleration in recent research due to its practical implications in enhancing operational efficiency and promoting environmentally

sustainable practices (Broccardo et al., 2023; George et al., 2020). For example, AI-powered automation holds considerable potential to innovate organizational processes by integrating machine learning into daily operations, thereby reducing human error and increasing efficiency (Vaska et al., 2021). Yet, the challenges associated with AI adoption—such as ethical concerns, data privacy, and the need for human oversight—remain significantly underdeveloped and warrant rigorous investigation (Saurin et al., 2024)

Furthermore, the intersection of DT with other recent management practices, such as cultural intelligence and global workforce management, represents a promising area. As digitalization increasingly facilitates global operations, understanding cultural intelligence comprehensively and its role in managing digital workforces across borders becomes a strategic requirement (Malik et al., 2022). Research exploring these intersections could provide valuable insights into optimizing global digital operations (Malik et al., 2022).

Additionally, it is essential that researchers broaden the geographical coverage of DT research by incorporating a wider range of diverse and underrepresented regions, including areas such as Africa and Latin America. This would help us have an overview of DT around the world. Additionally, combining DT with other emerging concepts, like cultural intelligence, could provide deeper insights into how organizations can effectively utilize DT in an integrated and interdependent world. Moreover, researchers are also encouraged to debate and have multiple perspectives to find more about the drawbacks of DT, such as cybersecurity or high-skill requirements (Saeed et al., 2023; Saurin et al., 2024). By doing this, we can find ways to prepare and facilitate the DT process.

6.2. Implications for Business Managers and Policymakers

The findings suggest that DT plays a key role in improving both organizational and national outcomes. Typically, DT has been shown to improve resilience and sustainable development after the pandemic era. Therefore, business managers should be proactive in digitalizing their organizational functions. Alongside training and equipping employees with sufficient knowledge, they also need to keep studying and innovating to keep up with or go ahead of the dynamic world development. DT should not be viewed as an optional competency but rather as an obligatory element in the digital era.

For policymakers, the study highlights the need to integrate DT into education and professional development frameworks. Training the future labor force with DT will provide them with enough knowledge to leverage modern technology and work effectively. Moreover, making the most of technology also makes the research more convenient and efficient, allowing them to approach and create new innovations easily.

6.3. Limitation

This paper has some disadvantages despite its comprehensive methodology. The reliance on a bibliometric approach may not fully convey the depth of qualitative insights studied in DT research because this method mainly focuses on quantitative data. In addition, though Web of Science is a comprehensive database, it may not contain relevant studies published in regional or

non-indexed journals. To provide a more comprehensive knowledge of DT, future research could profit from integrating larger databases and qualitative assessments.

REFERENCES

Beier, G., Fritzsche, K., Kunkel, S., Matthess, M., Niehoff, S., Reißig, M., & van Zyl-Bulitta, V. (2020). *A green digitalized economy? Challenges and opportunities for sustainability*. https://publications.rifs-potsdam.de/pubman/faces/ViewItemFullPage.jsp?itemId=item_6000196_2&view=ACTIONS

BOWERSOX, D. J., Closs, D. J., & Drayer, R. (2005). The digital transformation: Technology and beyond. *SUPPLY CHAIN MANAGEMENT REVIEW, V. 9, NO. 1 (JAN./FEB. 2005), P. 22-29: ILL*, *9*(1). https://trid.trb.org/View/751438

Bozeman, B., & Corley, E. (2004). Scientists' collaboration strategies: Implications for scientific and technical human capital. *Research Policy*, *33*(4), 599–616.

Buss, D. (2018, November 7). *CEO Voices: Digital Transformation Is Everything*. ChiefExecutive.Net. https://chiefexecutive.net/ceo-voices-digital-transformation/

Bresciani, S., Huarng, K.-H., Malhotra, A., & Ferraris, A. (2021). Digital transformation as a springboard for product, process and business model innovation. In *Journal of Business Research* (Vol. 128, pp. 204–210). Elsevier. https://www.sciencedirect.com/science/article/pii/S0148296321000734

Broccardo, L., Truant, E., & Dana, L.-P. (2023). The interlink between digitalization, sustainability, and performance: An Italian context. *Journal of Business Research*, *158*, 113621.

Carroll, N., & Conboy, K. (2020). Normalising the "new normal": Changing tech-driven work practices under pandemic time pressure. *International Journal of Information Management*, *55*, 102186.

Chen, P., & Kim, S. (2023). The impact of digital transformation on innovation performance-The mediating role of innovation factors. *Heliyon*, *9*(3). https://www.cell.com/heliyon/fulltext/S2405-8440(23)01123-4

Correani, A., De Massis, A., Frattini, F., Petruzzelli, A. M., & Natalicchio, A. (2020). Implementing a Digital Strategy: Learning from the Experience of Three Digital Transformation Projects. *California Management Review*, *62*(4), 37–56. https://doi.org/10.1177/0008125620934864

Fitzgerald, M., Kruschwitz, N., Bonnet, D., & Welch, M. (2014). Embracing digital technology: A new strategic imperative. *MIT Sloan Management Review*, *55*(2), 1.

Freund, C. L., & Weinhold, D. (2004). The effect of the Internet on international trade. *Journal of International Economics*, *62*(1), 171–189.

George, G., Lakhani, K., & Puranam, P. (2020). What has changed? The impact of Covid pandemic on the technology and innovation management research agenda. *Journal of Management Studies*.

George, G., & Schillebeeckx, S. J. (2022a). Digital transformation, sustainability, and purpose in the multinational enterprise. *Journal of World Business*, *57*(3), 101326.

George, G., & Schillebeeckx, S. J. (2022b). Digital transformation, sustainability, and purpose in the multinational enterprise. *Journal of World Business*, *57*(3), 101326.

Ghobakhloo, M. (2020). Industry 4.0, digitization, and opportunities for sustainability. *Journal of Cleaner Production*, *252*, 119869.

Hanelt, A., Bohnsack, R., Marz, D., & Antunes Marante, C. (2021). A Systematic Review of the Literature on Digital Transformation: Insights and Implications for Strategy and Organizational Change. *Journal of Management Studies*, *58*(5), 1159–1197. https://doi.org/10.1111/joms.12639

Hajishirzi, R., Costa, C. J., Aparicio, M., & Romão, M. (2022). Digital Transformation Framework: A Bibliometric Approach. In A. Rocha, H. Adeli, G. Dzemyda, & F. Moreira (Eds.), *Information Systems and Technologies* (Vol. 470, pp. 427–437). Springer International Publishing. https://doi.org/10.1007/978-3-031-04829-6_38

Hitt, M. A., Tihanyi, L., Miller, T., & Connelly, B. (2006). International Diversification: Antecedents, Outcomes, and Moderators. *Journal of Management*, *32*(6), 831–867. https://doi.org/10.1177/0149206306293575

Judijanto, L. (2025). The Impact of Digital Transformation on Business Models: A Bibliometric Study. *The Eastasouth Management and Business*, *3*(02), 255–267.

Lazarides, M. K., Lazaridou, I.-Z., & Papanas, N. (2023). Bibliometric Analysis: Bridging Informatics With Science. *The International Journal of Lower Extremity Wounds*, 15347346231153538. https://doi.org/10.1177/15347346231153538

Li, F. (2020). The digital transformation of business models in the creative industries: A holistic framework and emerging trends. *Technovation*, *92*, 102012.

Li, S., Gao, L., Han, C., Gupta, B., Alhalabi, W., & Almakdi, S. (2023). Exploring the effect of digital transformation on Firms' innovation performance. *Journal of Innovation & Knowledge*, *8*(1), 100317.

Li, Y., & Zhang, Q. (2024). Corporate Digital Transformation and the Internationalization of R&D. *Sustainability*, *16*(21), 9262.

Liere-Netheler, K., Packmohr, S., & Vogelsang, K. (2018). *Drivers of digital transformation in manufacturing*. https://aisel.aisnet.org/hicss-51/in/digital_supply_chain/2/

Lokuge, S., Sedera, D., Grover, V., & Dongming, X. (2019). Organizational readiness for digital innovation: Development and empirical calibration of a construct. *Information & Management*, *56*(3), 445–461.

Lopes de Sousa Jabbour, A. B., Jabbour, C. J. C., Godinho Filho, M., & Roubaud, D. (2018). Industry 4.0 and the circular economy: A proposed research agenda and original roadmap for sustainable operations. *Annals of Operations Research*, *270*(1–2), 273–286. https://doi.org/10.1007/s10479-018-2772-8

Lyytinen, K., Yoo, Y., & Boland Jr., R. J. (2016). Digital product innovation within four classes of innovation networks. *Information Systems Journal*, *26*(1), 47–75. https://doi.org/10.1111/isj.12093

Malik, A., Sharma, P., Kingshott, R., & Laker, B. (2022). Leveraging cultural and relational capabilities for business model innovation: The case of a digital media EMMNE. *Journal of Business Research*, *149*, 270–282.

Martin, A. (2008). Digital literacy and the "digital society." *Digital Literacies: Concepts, Policies and Practices*, *30*(151), 1029–1055.

Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. *Business & Information Systems Engineering*, *57*(5), 339–343. https://doi.org/10.1007/s12599-015-0401-

hoice+for+business+to+survive,+smash,+and+conquer,%E2%80%9D+Mississauga,+2014&ots=Xahb_qINy4&sig=EJKTTN2UCN_RBxi1LOQJSh78qUI

Mazzone, D. M. (2014). *Digital or death: Digital transformation: the only choice for business to survive smash and conquer*. Smashbox Consulting Inc. https://www.google.com/books?hl=vi&lr=&id=nI8ZBQAAQBAJ&oi=fnd&pg=PP11&dq=D.+Mazzone,+%E2%80%9CDigital+or+dnaheath:+digital+transformation+%E2%80%93+the+onlyc

Nah, F. F.-H., & Siau, K. (2020). COVID-19 Pandemic – Role of Technology in Transforming Business to the New Normal. In C. Stephanidis, G. Salvendy, J. Wei, S. Yamamoto, H. Mori, G. Meiselwitz, F. F.-H. Nah, & K. Siau (Eds.), *HCI International 2020 – Late Breaking Papers: Interaction, Knowledge and Social Media* (Vol. 12427, pp. 585–600). Springer International Publishing. https://doi.org/10.1007/978-3-030-60152-2_43

Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital innovation management. *MIS Quarterly*, *41*(1), 223–238.

Negroponte, N. (1997). Being digital. *Computers in Physics*, *11*(3). https://scholar.archive.org/work/6lc6zb67jzfudfx6mc5eaumlta/access/wayback/http://sajlis.journals.ac.za/pub/article/download/1488/1386

Oh, K., Kho, H., Choi, Y., & Lee, S. (2022). Determinants for successful digital transformation. *Sustainability*, *14*(3), 1215.

Orlikowski, W. J. (2000). Using Technology and Constituting Structures: A Practice Lens for Studying Technology in Organizations. *Organization Science*, *11*(4), 404–428. https://doi.org/10.1287/orsc.11.4.404.14600

Pan, W., Xie, T., Wang, Z., & Ma, L. (2022). Digital economy: An innovation driver for total factor productivity. *Journal of Business Research*, *139*, 303–311.

Papagiannidis, S., Harris, J., & Morton, D. (2020). WHO led the digital transformation of your company? A reflection of IT related challenges during the pandemic. *International Journal of Information Management*, *55*, 102166.

Poole, M. S., & Van de Ven, A. H. (2004). *Handbook of organizational change and innovation*. Oxford University Press. https://books.google.com/books?hl=vi&lr=&id=Puvw387jmkC&oi=fnd&pg=PR7&dq=Marshall+Scott+Poole,+Andrew+H.Van+de+Ven.+(2004).+Organizational+Change+and+Innovation.+OXFORD+University+press&ots=2Ll_744ZPd&sig=mu9PlfIXPqvn3DP8eV_Hxb_IjXI

Saeed, S., Altamimi, S. A., Alkayyal, N. A., Alshehri, E., & Alabbad, D. A. (2023). Digital transformation and cybersecurity challenges for businesses resilience: Issues and recommendations. *Sensors*, *23*(15), 6666.

Saurin, T. A., Patriarca, R., Hegde, S., & Rayo, M. (2024). The influence of digital technologies on resilient performance: Contributions, drawbacks, and a research agenda. *Applied Ergonomics*, *118*, 104290.

Schneider, S., & Kokshagina, O. (2021). Digital transformation: What we have learned (thus far) and what is next. *Creativity and Innovation Management*, *30*(2), 384–411. https://doi.org/10.1111/caim.12414

Schroeck, M., Kawamura, J., & Kwan, A. (2019). Digital transformation as a path to growth. *Deloitte Insights*.

Teece, D. J. (2018). Business models and dynamic capabilities. *Long Range Planning*, *51*(1), 40–49.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509–533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Teng, X., Wu, Z., & Yang, F. (2022). Research on the relationship between digital transformation and performance of SMEs. *Sustainability*, *14*(10), 6012.

Tihanyi, C., Schumacher, C., & Mohr, A. T. (2021). International Diversification, Digital Transformation, and the Performance of MNEs. *Academy of Management Proceedings*, *2021*(1), 14848. https://doi.org/10.5465/AMBPP.2021.14848abstract

Vaska, S., Massaro, M., Bagarotto, E. M., & Dal Mas, F. (2021). The digital transformation of business model innovation: A structured literature review. *Frontiers in Psychology*, *11*, 539363.

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, *28*(2), 118–144.

Wei, Y. Y., Gong, X. Y., & Liu, C. (2022). Does digital transformation improve firms' export resilience. *J. Int. Trade*, *10*, 56–72.

Zahra, S. A., & George, G. (2002). Absorptive Capacity: A Review, Reconceptualization, and Extension. *The Academy of Management Review*, *27*(2), 185. https://doi.org/10.2307/4134351

Zhao, X., Chen, Q., Yuan, X., Yu, Y., & Zhang, H. (2024). Study on the impact of digital transformation on the innovation potential based on evidence from Chinese listed companies. *Scientific Reports*, *14*(1), 6183.

Zhou, Y., Ock, Y.-S., Alnafrah, I., & Dagestani, A. A. (2023). What aspects explain the relationship between digital transformation and financial performance of firms? *Journal of Risk and Financial Management*, *16*(11), 479.